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SEALING QUALITY OF A TEMPORARY FILLING MATERIAL.(U)
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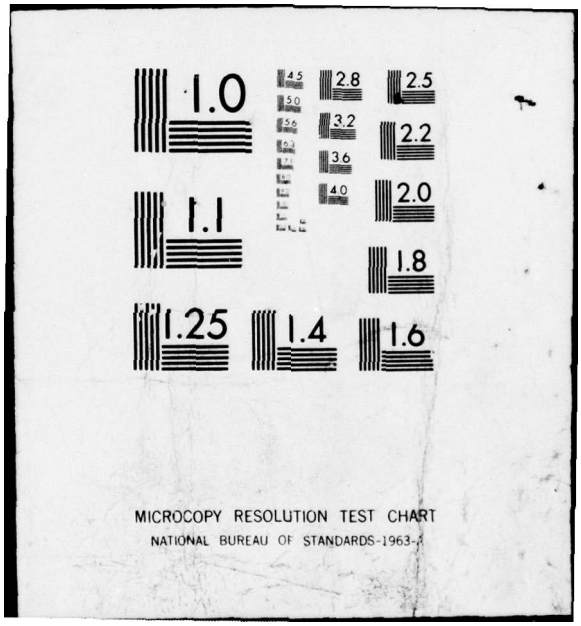
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SEALING QUALITY OF A TEMPORARY FILLING MATERIAL

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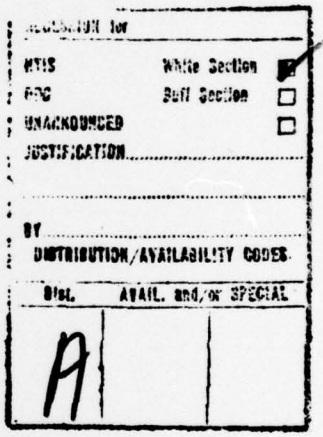

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ABSTRACT

Access cavities obturated with Cavit were tested for leakage with methylene blue. A thickness of 3.5 mm of Cavit was needed to prevent leakage.

The function of a temporary filling material in endodontics is twofold: first, to prevent the saliva with its microorganisms from gaining entrance into the root canal, thus preventing infection or re-infection; second, to prevent medicaments placed into the pulp chamber from escaping into the oral cavity, thereby preserving the effectiveness of the intracanal medication and preventing any chemical burn to the oral mucosa. If these criteria are to be met, the sealing qualities of a temporary filling material are of primary importance in endodontic therapy.[1,2,3 & 4]

Many studies have been made related to the sealing qualities of various temporary filling materials used in restorative dentistry but few studies have dealt specifically with their use in endodontics.[5-18]

Glass capillary tubes were used by Grossman to study zinc oxide-eugenol, zinc oxyphosphate, and gutta percha. In this study zinc oxide-eugenol showed no leakage. This quality was attributed to its property of expansion on contact with moisture.

Zinc oxyphosphate cement was the least effective with gutta percha having an intermediate position.[19] Massler confirmed the previous findings and added that zinc oxide-eugenol and amalgam fillings presented the most effective marginal sealing qualities.[20]

Neither zinc oxide-eugenol nor Cavit*, a zinc oxide and polyvinyl preparation, permitted bacterial penetration in the studies of Parris

*Premier, Philadelphia, Pa.

and Kapsimalis. Zinc oxide-eugenol did not show leakage at room temperature but leaked in five out of ten access cavities subjected to temperature changes. Cavit maintained a leak-proof seal both at room and at thermal temperatures ranging from 60°C to 4°C.[21,22]

The coefficient of linear expansion for Cavit was almost double that of zinc oxide-eugenol which explains its effectiveness as a temporary sealing material.[23] The compressive strength of Cavit has been estimated to be approximately half that of zinc oxide-eugenol, thus showing a lack of marginal strength.[23] For this reason, and to prevent absorption of saliva from the oral cavity and medicaments from the access cavity, the bulk of the restoration is an important factor if Cavit is going to be used as a temporary filling material.

There are other variables besides the temporary sealing material that can cause leakage. Improper access cavity preparation can leave fractured enamel walls to produce a marginal gap up to ten microns.[24,26] Poor adaptation to cavity walls, debris between cavity wall and temporary restorations, and deterioration of the temporary filling material may lead to marginal seal failure.[24,25]

The use of a double seal has been advocated to improve the sealing quality of the temporary restorations. This second seal of gutta percha aids only in the support of the outer seal, Cavit or zinc oxide-eugenol, against occlusal stresses. It does not improve the sealing quality of the temporary filling.[3,27]

Patients undergoing endodontic treatment at our clinic occasionally complained of a foul taste or a burning sensation. This is evidence

of an inadequate seal even though leakage is not apparent on visual examination.[28] For the above reason this study was designed to evaluate the thickness of Cavit necessary to achieve an appropriate seal.

Methods and Materials Part I

Forty extracted human molar teeth were selected for their occlusal integrity and stored until their use in water. Endodontic access cavity preparations were performed. The pulp chamber content was removed but no attempt was made to remove material from the root canal.

The teeth were immersed six times in melted wax up to the cemento-enamel junction to produce an impermeable coating on the roots. A dry cotton pellet was placed in half of the specimens and, in the other half, a cotton pellet was moistened in camphorated parachlorophenol, compressed to dryness and placed in the chamber. Care was exercised so that no cotton fibers were left attached to the cavity wall to serve as a wick and that at least 5 mm. of space was left to allow adequate space for the temporary restoration of Cavit.

After the insertion, the Cavit temporary filling was blotted with a wet cotton ball and the teeth were immersed in a solution of 10 cc of 10% methylene blue* in water filtered through a 50 millimicron filter. The teeth remained in the solution at 37°C for forty-eight hours. No effort was made in this experiment to simulate the viscosity of saliva which Grossman determined would help prevent leakage.[19]

The teeth were removed from the dye solution, washed with water and examined for integrity of the wax protective coating. When any dye was

*Stock methylene blue is 1.4 gm of methylene blue to 95% alcohol per 100 cc.

detected on the root surface of the tooth, that tooth was discarded and another test-specimen used.

Each specimen was fractured mesio-distally and the cotton pellet examined for dye discoloration, the temporary filling material for dye penetration and the filling-tooth interface for dye penetration (Figure 1). The penetration of the dye was measured with a vernier calpier and recorded.

PART II

Five maxillary central incisors were selected with complete occlusal integrity and stored in water until their use. Standard endodontic access cavity preparations were performed. A dry cotton pellet was placed in the chamber and Cavit was condensed into the access cavity. Care was exercised so that no cotton fibers were left attached to the cavity wall to serve as a wick and that at least 5 mm. of space was left to allow adequate space for the temporary restorative material. After the insertion, the Cavit temporary filling was blotted with a wet cotton ball to accelerate the setting.

The roots were cut at the cervical line and the crowns were fixed to aluminum stubs, coated with carbon and examined in a scanning electron microscope*.

Results Part I

The results of the dye penetration measurements are presented in the table. The penetration of the dye into the mass of Cavit was the same as the penetration of the Cavit-tooth interphase. There was an apparent

*Model AMR 1000, Advanced Metal Research Corporation, Bedford, MA

difference in penetration depending upon the presence or absence of medication beneath the Cavit. This mean penetration of the dye was 2.65 mm. in the medicated cavity and 2.51 mm. in the non-medicated cavity. The results were statistically analysed using the student "t" test and the results were not statisticaly significant (Table I). The range of penetration varied from 2.5 to 3.2 mm. when both medicated and non-medicated cavities were combined.

Part II

Examination under the scanning electron microscope revealed good adaptation of the Cavit to the access cavity wall (Figure 3) in most of the peripheral area but there were crevices ranging from 37μm to 63μm (Figure 4) in some regions.

The surface of the Cavit appears particulate except for one crystallin-like area containing a powdery material high in calcium content and rod-like structures with a high content of zinc (Figures 2 & 5).

Discussion

There are two areas of interest in the study of temporary sealers; the integrity of the tooth-filling interphase and the permeability of the material itself. The penetration of the dye in the tooth-filling interphase was the same as the permeability into the material, strongly suggesting that the leakage potential of Cavit is due to its hydroscopic properties. Our conclusions point out that in order to improve the inter-visit seal, a filling thickness of at least 3.5 mm. of Cavit should be used. This tends to parallel Fogel's study.[29]

Examination with the SEM showed that the constituent materials of Cavit had not been thoroughly mixed probably adding to the permeability.

The crevices found between the access cavity wall and the Cavit could be dehydration artifacts in preparation of the specimen.

During the pilot phase of this investigation, intermediate restorative material (IRM)* was used according to the manufacturer's direction. It was observed that setting was prevented within the one millimeter of material adjacent to the cotton containing camphorated parachlorophenol and the authors do not recommend its use with this medicament. The pilot study showed no difference in penetration of dye between teeth that were doubly or singly scaled. Penetration appears to be solely dependent on the thickness of the Cavit.[30]

Summary

Endodontic access cavities were prepared in forty extracted human teeth. The access cavities were obturated with Cavit and tested for leakage with methylene blue. The data suggested that at least a 3.5 mm. thickness of Cavit should be used in order to prevent leakage. Examination under the scanning electron microscope showed areas in which the constituents of Cavit were improperly mixed which may lead to increase penetration.

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Figure 1. Mesio-distal section of specimen with Cavit (1), cotton (2) and apical margin of dye penetration (*).

Figure 2. Electron micrograph of Cavit temporary filling. Note areas of good marginal adaptation (a), crevices (b) to access cavity wall and area of defective mix (c). (20X)

Figure 3. Higher magnification of area "a" showing good marginal adaptation. (200X)

Figure 4. Higher magnification of area "b" showing marginal crevis. (200X)

Figure 5. Higher magnification of area "c" showing powdery material (Ca) and rod-like structures (Zn). (950X)

TABLE I

Millimeters of Dye Penetration

Medicated	Non-medicated
2.4	2.2
2.4	2.5
2.9	2.7
3.0	2.7
3.1	2.6
3.1	2.6
2.6	2.5
3.2	3.0
2.6	2.2
2.6	2.8
2.3	2.5
2.6	2.5
2.1	2.5
2.2	2.7
3.0	2.3
2.5	2.4
2.9	2.5
2.5	2.4
2.5	2.4
2.5	2.2
MEANS 2.65	2.51

df = 38
p<.20
t=1.64

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FIGURE 1

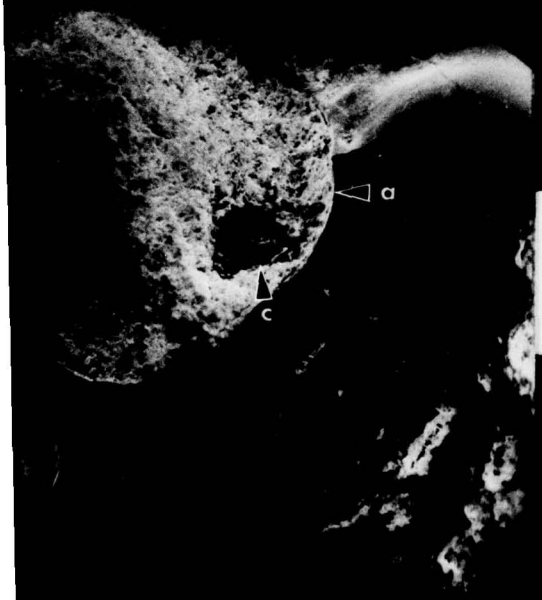

FIGURE 2

FIGURE 5